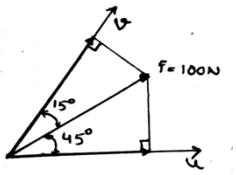
M.E. Mechanical Engineering

1. Determine the magnitude of the projection of the vector force F = 100N, onto u axis, from the figure given below.



A) 96.6N
B) 60N
C) 100N
D) 70.7N

2. What is {(i.i) + (-i.j) + (-k.k) + (k.i)}.(Ai +Bj + Cz)?
A) 1 B) 0 C) A + B + C D) -1

3. Which of the following is correct in the determination of the moment direction by curling of wrist?
A) The thumb represents the direction of the force
B) The thumb represents the direction of the moment
C) The fingers represent the direction of the force
D) The direction in which you curl your wrist is towards the direction of the distance from point of contact of force to the axis of rotation.

4. The ultimate tensile strength of a material is 400 MPa and the elongation up to maximum load is 35%. If the material obeys power law of hardening, then the true stress-true strain relation (stress in MPa) in the plastic deformation range is:
A) $\sigma = 540\epsilon^{0.30}$ B) $\sigma = 775\epsilon^{0.30}$ C) $\sigma = 540\epsilon^{0.35}$ D) $\sigma = 775\epsilon^{0.35}$

5. The relationship between Young's modulus (E), Bulk modulus (K) and Poisson's ratio (μ) is given by:
A) $E = 3K(1-2\mu)$ B) $K = 3E(1-2\mu)$ C) $E = 3K(1-\mu)$ D) $K = 3E(1-\mu)$

6. An ejector mechanism consists of a helical compression spring having a spring constant of $K = 981 \times 10^3$ N/m. It is pre-compressed by 100 mm from its free state. If it is used to eject a mass of 100 kg held on it, the mass will move up through a distance of
A) 100mm B) 500mm C) 981 mm D) 1000mm

7. A solid uniform metal bar of diameter D and length L is hanging vertically from its upper end. The elongation of the bar due to self weight is:
A) Proportional to L and inversely proportional to D^2
B) Proportional to L2 and inversely proportional to D^2
C) Proportional of L but independent of D
D) Proportional of U but independent of D

8. If the value of Poisson's ratio is zero, then it means that
A) The material is perfectly plastic.

B) The material is rigid.
C) There is no longitudinal strain in the material
D) The longitudinal strain in the material is infinite.

9. A solid circular shaft of diameter 100 mm is subjected to an axial stress of 50MPa. It is further subjected to a torque of 10 kNm. The maximum principal stress experienced on the shaft is closest to

A) 41 MPa B) 82 MPa C) 164 MPa D) 204 MPa

10. The second moment of a circular area about the diameter is given by (D is the diameter)

A) $\frac{\pi D4}{4}$ B) $\frac{\pi D4}{16}$ C) $\frac{\pi D4}{32}$ D) $\frac{\pi D4}{64}$

11. The shapes of the bending moment diagram for a uniform cantilever beam carrying a uniformly distributed load over its length is:

A) A straight line B) A hyperbola C) An ellipse D) A parabola

12. A solid circular shaft of 60 mm diameter transmits a torque of 1600 N.m. The value of maximum shear stress developed is:

A) 37.72 MPa B) 47.72 MPa C) 57.72 MPa D) 67.72 MPa

13. A penstock pipe of 10m diameter carries water under a pressure head of 100 m. If the wall thickness is 9 mm, what is the tensile stress in the pipe wall in MPa?

A) 2725 B) 545.0 C) 272.5 D) 1090

14. The number degrees of freedom of a planar linkage with 8 links and 9 simple revolute joints is

A) 1 B) 2 C) 3 D) 4

15. The number of inversions for a slider crank mechanism is

A) 6 B) 5 C) 4 D) 3

16. The lengths of the links of a 4-bar linkage with revolute pairs only are p, q, r, and s units. Given that $p < q < r < s$. Which of these links should be the fixed one, for obtaining a "double crank" mechanism?

A) Link of length p B) link of length q C) Link of length r D) link of length s

17. 1) The degree of freedom for lower kinematic pairs is always equal to one.
2) A ball-and-socket joint has 3 degrees of freedom and is a higher kinematic pair
3) Oldham's coupling mechanism has two prismatic pairs and two revolute pairs.
Which of the statements given above is/are correct?

A) 1, 2 and 3 B) 1 only C) 2 and 3 D) 3 only

18. Maximum angular velocity of the connecting rod with a crank to connecting rod ratio 1: for a crank speed of 3000 rpm is around:

A) 300 rad/s B) 60 rad/s C) 30 rad/s D) 3000 rad/s

19. A fly wheel of moment of inertia 9.8 kgm^2 fluctuates by 30 rpm for a fluctuation in energy of 1936 Joules. The mean speed of the flywheel is (in rpm)

A) 600 B) 900 C) 968 D) 2940

20. For a certain engine having an average speed of 1200 rpm, a flywheel approximated as a solid disc, is required for keeping the fluctuation of speed within 2% about the average speed. The fluctuation of kinetic energy per cycle is found to be 2 kJ. What is the least possible mass of the flywheel if its diameter is not to exceed 1m?

A) 40 kg B) 51 kg C) 62 kg D) 73 kg

21. When a body slides down an inclined surface, inclined at an angle β, the acceleration 'a' of the body is given by

A) $a = g$ B) $a = g \sin\beta$ C) $a = g \cos\beta$ D) $a = g \tan\beta$

22. Longitudinal stress in a thin cylinder is

A) Equal to the hoop stress B) Twice the hoop stress

C) Half of the hoop stress D) One fourth of hoop stress

23. A boiler shell 200 cm diameter and plate thickness 1.5 cm is subjected to internal pressure of 1.5 MN/m, then the hoop stress will be

A) 30 MN/m^2 B) 50 MN/m^2 C) 100 MN/m^2 D) 200 MN/m^2

24. The type of threads used to transmit power in one direction only is

A) Acme B) Trapezoidal C) Buttress D) V thread

25. The Coefficient of fluctuation of energy of flywheel is given a

Where E_{max} = Maximum Kinetic energy of the Flywheel

E_{min} = Minimum Kinetic energy of the Flywheel

A) $(E_{max} - E_{min})$/Work done per cycle B) $(E_{max} + E_{min})$/Work done per cycle

C) $(E_{max} - E_{min})$ x Work done per cycle D) $(E_{max} + E_{min})$ x Work done per cycle

26. A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is

A) 2 B) 4 C) 3 D) None of these

27. A metric thread of pitch 2mm and thread angle 60º is inspected for its pitch diameter using 3-wire method. The diameter of the best size wire in mm is

A) 0.86 B) 1.0 C) 1.15 D) 2.0

28. Two shafts A and B under pure torsion are of identical length and identical weight and are made of the same material. The shaft A is solid and the shaft B is hollow. We can say that

A) Shaft B is better than shaft A B) Shaft A is better than shaft B

C) Both the shafts are equally good D) None of the above

29. The maximum shear stress theory is used for

A) Brittle materials B) Ductile materials
C) Plastic materials D) Non-ferrous materials

30. Soderberg relation is based on _____ of the material whereas all other failure relation for dynamic loading are based on ultimate strength of the material
A) Elastic strength B) Yield strength C) Shear strength D) All of these

31. In grey cast iron, carbon is present in the form of
A) Cementite B) Free carbon C) Flakes D) Spheroids

32. Cyaniding is the process of
A) Dipping steel in cyanide bath
B) Reacting steel surface with cyanide salts
C) Adding carbon and nitrogen by heat treatment of steel to increase its surface hardness
D) Obtaining cyanide salts

33. Cupola produces following material
A) Cast iron B) Pig iron C) Wrought iron D) Malleable iron

34. As the shear angle increases, the plastic deformation of chip
A) Increases B) Decreases C) Remains same D) None of these

35. Cutting forces at the cutting tool can be measured by
A) A dynamometer B) A viscosity meter
C) A sine bar D) A combination set

36. The clearance angle is provided on the tools with a view to
A) Strength the tool
B) Shear off the metal
C) Facilitate easy flow of chips
D) Prevent the tool from rubbing on work piece

37. On a lathe machine, the spindle speed is lowest during
A) Taper turning B) Threading C) Parting off D) Knurling

38. In oxidizing flame, the inner core attains a temperature of …….. °C
A) 2100 B) 2800 C) 3150 D) 3500

39. Plastic bottles are manufactured using the process of
A) Blow moulding B) Injection moulding
C) Atomizing D) Die casting

40. Using the Taylor equation $VT^n = c$, calculate the percentage increase in tool life when the cutting speed is reduced by 50% (n = 0.5 and c = 400)
A) 300 B) 400% C) 100% D) 50%

41. In a rolling process, the state of stress of the material undergoing deformation is

A) Pure compression B) Pure shear
C) Compression and shear D) Tension and shear

42. The process that improves the machinability of steels, but lowers the hardness and tensile strength is

A) Normalizing B) Annealing C) Tempering D) Hardening

43. If δQ is the heat transferred to the system and δW is the work done by the system, then which of the following is an exact differential

A) δQ B) δW C) δQ + δW D) δQ – δW

44. A pitot tube measures:

A) Static pressure
B) Dynamic pressure
C) Total pressure
D) Difference between total and dynamic pressure

45. The inlet value of a four stroke cycle I.C engine remains open for nearly

A) 180° B) 125° C) 235° D) 200°

46. Which instrument is used for surface roughness measurement

A) Clinometer B) Auto-collimeter C) Optical square D) Profilometer

47. The meaning of 'Payoffs' in Game Theory is

A) Outcome of a game when different alternatives are adopted by players
B) No. of players involved in a game
C) Value of a game
D) Strategies used by players

48. The North West Corner rule

A) Is used to find an initial feasible solution
B) Is used to find an optimal solution
C) Is based on the concept of minimizing opportunity cost
D) None of these

49. In a process chart, the square symbol represents

A) Transport B) Inspection D) Action D) Delay

50. A negative loop in the P.V diagram of an I.C engine is due to

A) Pre ignition in the engine B) Suction of air for engine
C) Pre opening of the exhaust valve D) High pressure in the cylinder

51. A 1 ton capacity water cooler cools water steadily from 35°C to 20°C. The specific heat of water is 4.18 KJ/kg-K. The water flow rate will be nearly.

A) 13.33 litre/hr B) 33.3 litre/hr C) 200 litre/hr D) 250 litre/hr

52. Which of the following is a non positive displacement type of compressor

A) Reciprocating compressor B) Centrifugal compressor
C) Root blower D) Vane type compressor

53. The maximum possible draft in cold rolling of sheet increases with the

A) Increase in coefficient of friction B) Decrease in coefficient of friction
C) Decrease in roll radius D) Increase in roll velocity

54. Streamlines, path lines and streak lines are virtually identical for

A) Uniform flow B) Flow for ideal fluids
C) Steady flow D) Non uniform flow

55. Eutectic reaction for iron- carbon system occurs at

A) $600\ ^0$C B) 723^0C C) 1147^0C D) 1490^0C

56. The crystal structure of α iron is

A) Simple Cubic B) Face centered cubic
C) Body centered cubic D) Close packed hexagonal

57. To show the internal parts of machine components, the section lines are drawn at angle of

A) 45^0 B) 0^0 C) 60^0 D) 90^0

58. Which of the following statements are FALSE about the buoyancy of an object

A) The force of buoyancy on a ship is equal to the weight of the water displaced by the ship and its cargo.
B) Buoyancy explains why it is easier to lift an object in water than it is in air.
C) An object only has buoyancy in air.
D) An object only has buoyancy in liquids.

59. Cavitations in centrifugal pumps can be reduced by

A) Reducing the discharge B) Reducing the suction head
C) Throttling the discharge D) Increasing the flow velocity

60. The Weber number in dimensionless system is expressed as

A) $\frac{V}{\sqrt{\sigma/\rho L}}$ B) $\frac{V}{\sigma\sqrt{\rho L}}$ C) $\frac{\sigma V}{\sqrt{\rho L}}$ D) $\frac{\sqrt{\sigma/\rho L}}{V}$,

Where σ is surface tension per unit length.

61. The heat is absorbed by

A) Condenser B) Evaporator C) Compressor D) Thermostat

62. Work study includes

A) Method study B) Motion study C) Time study D) All of these

63. At breakeven point

A) Fixed costs are recovered B) Variable costs are recovered

C) Total costs are recovered D) Some costs are recovered

64. The word kanban is most appropriately associated with
A) Economic order quantity B) Just–in–time production
C) Capacity planning D) Product design

65. A linear programming problem is shown below:

Maximize $3x + 7y$

Subject to

$3x + 7y \leq 10$

$4x + 6y \leq 8$

$x, y \geq 0$

It has

A) An unbounded objective function
B) Exactly one optimal solution
C) Exactly two optimal solutions
D) Infinitely many optimal solutions

66. The following is used to check the diameters of holes
A) Plug gauge
B) Ring gauge
C) Slip gauge
D) Standard screw pitch gauge

67. Which quality management program is related to the maintenance of plants and equipments
A) Environmental management systems B) Fault tree analysis
C) Failure mode effect analysis D) Total productive maintenance

68. Which of the following is true for interference fit
A) Shaft is always smaller than the hole
B) Shaft is always bigger than the hole
C) Interference fits have shaft and hole of same dimension
D) None of the above

69. Which of the following is not a rule of network construction
A) Each defined activity is represented by one and only one arrow
B) A network should have only initial and one terminal node
C) Identical initial and final nodes can identify two activities
D) Only as few dummy activities should be included as is warranted.

70. Calculate the power required for machining of a workpiece on lathe having efficiency of 85% on full load, when tangential force required is 1200 N and cutting speed 195 m/min
A) 4.59 Kw B) 275.29 W C) 3.315 kW D) 8.145kW

71. Investment casting is used for

A) Shapes which are made by difficulty using complex patterns in sand casting
B) Mass production
C) Shapes which are very complex and intricate and can't be cast by any other method
D) There is nothing like investment casting

72. In which of the following methods, an electrolyte is used?

A) Ultrasonic Machining B) Electrochemical Machining
C) Abrasive Jet Machining D) Laser Beam Machining

73. In Ultrasonic machining, the material is removed by

A) Anodic dissolution B) Thermal melting
C) Abrasive action D) Electrochemical oxidation

74. The values of enthalpy of steam at the inlet and outlet of a steam turbine in a Rankine cycle are 2800kJ/kg and 1800kJ/kg respectively. Neglecting pump work, the specific steam consumption in kg/kW-hour is

A) 3.60 B) 0.36 C) 0.06 D) 0.01

75. The ratios of the laminar hydrodynamic boundary layer thickness to thermal boundary layer thickness of flows of two fluids P and Q on a flat plate are ½ and 2 respectively. The Reynolds number based on the plate length for both the flows is 10^4. The Prandtl and Nusselt numbers for P are 1/8 and 35 respectively. The Prandtl and Nusselt numbers for Q are respectively

A) 8 and 140 B) 8 and 70 C) 4 and 70 D) 4 and 35

x-x-x